

Serial No.: R53b Div of
SN 09/450,415 filed Nov. 30, 1999

IN THE CLAIMS:

1.-30. (Cancelled)

31. (Original) A method of manufacturing a liquid crystal element comprising a step of providing an information for aligning a liquid crystal molecule in a direction for a substrate with an electrode by applying a voltage.

32. (Original) A method of manufacturing a liquid crystal element comprising:

a first step of providing an information for aligning a liquid crystal molecule in a direction for two substrates holding a liquid crystal having the liquid crystal molecule by applying a voltage; and

a second step of providing an information for aligning the liquid crystal molecule in a different direction from said direction phasedly or gradually for said substrates.

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33. (Currently Amended) A method of manufacturing a liquid crystal element according to Claim 31—~~or~~—32, wherein said information for aligning is provided for the substrate by providing irregularities on a surface of at least one of the substrates.

34. (Currently Amended) A method of manufacturing a liquid crystal element according to Claim 31—~~or~~—33, wherein said irregularities are formed by patterning with a photosensitive resin.

35. (Original) A method of manufacturing a liquid crystal element according to Claim 34, wherein said irregularities are formed by patterning with a photomask.

36. (Original) A method of manufacturing a liquid crystal element according to Claim 34, wherein said irregularities are formed by patterning with interferential fringes of a laser.

37. (Original) A method of manufacturing a liquid crystal element according to Claim 34, wherein said irregularities are formed by patterning with a electron beam.

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38. (Original) A method of manufacturing a liquid crystal element according to Claim 34, wherein said irregularities are formed by patterning with a laser ablation.

39. (Original) A method of manufacturing a liquid crystal element according to Claim 34, wherein said photosensitive resin has a characteristic of a conductivity.

40. (Original) A method of manufacturing a liquid crystal element according to Claim 33, wherein said irregularities are formed in a direction by forming a film with an inorganic substance or an organic substance on a substrate, and adding a physical contact such as an extension, a scratch and a rub to the film.

41. (Original) A method of manufacturing a liquid crystal element according to Claim 40, wherein the film formed with an inorganic substance or an organic substance has a characteristic of a conductivity.

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42. (Original) A method of manufacturing a liquid crystal element according to Claim 33, wherein said irregularities are formed by transferring a pattern of irregularities, which is formed on another substrate beforehand, on a surface of a substrate.

43. (Original) A method of manufacturing a liquid crystal element according to Claim 32, wherein said information for aligning is provided by irradiating an ultraviolet ray in at least one of the first step and the second step.

44. (Original) A method of manufacturing a liquid crystal element according to Claim 32, wherein said information for aligning is provided by executing a rubbing treatment in at least one of the first step and the second step.

45.-50. (Cancelled)

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51. (Original) A liquid crystal element comprising:
a multitude of pixel electrodes which are divided minutely;
and

a liquid crystal to which an electric field is applied by
said pixel electrodes;

wherein:

an electric field direction of the liquid crystal between at
least one pair of adjacent pixels is inclined against an
electrode plane.

52. (Original) A liquid crystal element comprising:
a multitude of pixel electrodes which are divided minutely;
an opposite electrode which is disposed in parallel with
said pixel electrodes; and

a liquid crystal which is held between said pixel electrode
and opposite electrode;

wherein:

a nonconductive portion is provided in a part of the
opposite electrode which is opposite to a gap between at least
one pair of adjacent pixel electrodes.

53. (Original) A liquid crystal element, wherein a four-sided minute pixel electrode is arrayed in a lattice in X, Y directions crossing each other at a right angle on a display plane, comprising:

in view of Z direction at a right angle with X, Y directions when a pixel of i-th position in X direction and j-th position in Y direction from an edge point or a standard point is defined as $p(i, j)$,

a first nonconductive portion, with a rectangular shape having a longer side in Y direction and a larger width in X direction than a distance between a pixel $p(4m, 4n+1)$ and a pixel $p(4m+1, 4n+1)$, which includes an opposite electrode corresponding to each of at least a part of a gap between a pixel $p(4m, 4n)$ [m, n : an integer] and a pixel $p(4m+1, 4n)$ as well as at least a part of a gap between a pixel $p(4m, 4n+1)$ and a pixel $p(4m+1, 4n+1)$;

a second nonconductive portion, with a rectangular shape having a longer side in X direction and a larger width in Y direction than a distance between a pixel $p(4m+1, 4n+2)$ and a pixel $p(4m+1, 4n+3)$, which includes an opposite electrode corresponding to each of at least a part of a gap between a pixel $p(4m, 4n+2)$ and a pixel $p(4m, 4n+3)$ as well as at least a part

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of a gap between a pixel p ($4m+1$, $4n+2$) and a pixel p ($4m+1$, $4n+3$);

a third nonconductive portion, with a rectangular shape having a longer side in X direction and a larger width in Y direction than a distance between a pixel p ($4m+2$, $4n$) and a pixel p ($4m+2$, $4n+1$), which includes an opposite electrode corresponding to each of at least a part of a gap between a pixel p ($4m+2$, $4n$) and a pixel p ($4m+2$, $4n+1$) as well as at least a part of a gap between a pixel p ($4m+3$, $4n$) and a pixel p ($4m+3$, $4n+1$); and

a fourth nonconductive portion, with a rectangular shape having a longer side in Y direction and a larger width in X direction than a distance between a pixel p ($4m+2$, $4n+3$) and a pixel p ($4m+3$, $4n+3$), which includes an opposite electrode corresponding to each of at least a part of a gap between a pixel p ($4m+2$, $4n+2$) and a pixel p ($4m+3$, $4n+2$) as well as at least a part of a gap between a pixel p ($4m+2$, $4n+3$) and a pixel p ($4m+3$, $4n+3$).

54. (Original) A liquid crystal element, wherein a four-sided minute pixel electrode is arrayed in a lattice in X, Y directions crossing each other at a right angle on a display plane, comprising:

in view of Z direction at a right angle with X, Y directions when a pixel of i-th position in X direction and j-th position in Y direction from an edge point or a standard point is defined as $p(i, j)$,

a first nonconductive portion, with a rectangular shape having a longer side in Y direction and a larger width in X direction than a distance between a pixel $p(4m, 4n+1)$ and a pixel $p(4m+1, 4n+1)$, which includes an opposite electrode corresponding to each of at least a part of a gap between a pixel $p(4m, 4n)$ [m, n : an integer] and a pixel $p(4m+1, 4n)$ as well as at least a part of a gap between a pixel $p(4m, 4n+1)$ and a pixel $p(4m+1, 4n+1)$;

a second nonconductive portion, with a rectangular shape having a longer side in X direction and a larger width in Y direction than a distance between a pixel $p(4m+1, 4n+2)$ and a pixel $p(4m+1, 4n+3)$, which includes an opposite electrode corresponding to each of at least a part of a gap between a pixel $p(4m, 4n+2)$ and a pixel $p(4m, 4n+3)$ as well as at least a part

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of a gap between a pixel $p(4m+1, 4n+2)$ and a pixel $p(4m+1, 4n+3)$;

a third nonconductive portion, with a rectangular shape having a longer side in X direction and a larger width in Y direction than a distance between a pixel $p(4m+3, 4n+3)$ and a pixel $p(4m+3, 4n+4)$, which includes an opposite electrode corresponding to each of at least a part of a gap between a pixel $p(4m+2, 4n+3)$ and a pixel $p(4m+2, 4n+4)$ as well as at least a part of a gap between a pixel $p(4m+3, 4n+3)$ and a pixel $p(4m+3, 4n+4)$; and

a fourth nonconductive portion, with a rectangular shape having a longer side in Y direction and a larger width in X direction than a distance between a pixel $p(4m+2, 4n+2)$ and a pixel $p(4m+3, 4n+2)$, which includes an opposite electrode corresponding to each of at least a part of a gap between a pixel $p(4m+2, 4n+1)$ and a pixel $p(4m+3, 4n+1)$ as well as at least a part of a gap between a pixel $p(4m+2, 4n+2)$ and a pixel $p(4m+3, 4n+2)$.

55. (Original) A liquid crystal element, wherein a four-sided minute pixel electrode is arrayed in a lattice in X, Y directions crossing each other at a right angle on a display plane, comprising:

in view of Z direction at a right angle with X, Y directions when a pixel of i-th position in X direction and j-th position in Y direction from an edge point or a standard point is defined as $p(i, j)$,

a first nonconductive portion, with a rectangular shape having a longer side in Y direction and a larger width in X direction than a distance between a pixel $p(4m, 4n+1)$ and a pixel $p(4m+1, 4n+1)$, which includes an opposite electrode corresponding to each of at least a part of a gap between a pixel $p(4m, 4n)$ [m, n : an integer] and a pixel $p(4m+1, 4n)$ as well as at least a part of a gap between a pixel $p(4m, 4n+1)$ and a pixel $p(4m+1, 4n+1)$;

a second nonconductive portion, with a rectangular shape having a longer side in X direction and a larger width in Y direction than a distance between a pixel $p(4m+1, 4n+2)$ and a pixel $p(4m+1, 4n+3)$, which includes an opposite electrode corresponding to each of at least a part of a gap between a pixel $p(4m, 4n+2)$ and a pixel $p(4m, 4n+3)$ as well as at least a part

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of a gap between a pixel p ($4m+1$, $4n+2$) and a pixel p ($4m+1$, $4n+3$);

a third nonconductive portion, with a rectangular shape having a longer side in X direction and a larger width in Y direction than a distance between a pixel p ($4m+3$, $4n+1$) and a pixel p ($4m+3$, $4n+2$), which includes an opposite electrode corresponding to each of at least a part of a gap between a pixel p ($4m+2$, $4n+1$) and a pixel p ($4m+2$, $4n+2$) as well as at least a part of a gap between a pixel p ($4m+3$, $4n+1$) and a pixel p ($4m+3$, $4n+2$); and

a fourth nonconductive portion, with a rectangular shape having a longer side in Y direction and a larger width in X direction than a distance between a pixel p ($4m+2$, $4n$) and a pixel p ($4m+3$, $4n$), which includes an opposite electrode corresponding to each of at least a part of a gap between a pixel p ($4m+2$, $4n-1$) and a pixel p ($4m+3$, $4n-1$) as well as at least a part of a gap between a pixel p ($4m+2$, $4n$) and a pixel p ($4m+3$, $4n$).

56. (Currently Amended) A liquid crystal element according to Claim 53, ~~any one of Claims 53 to 55~~, wherein:

said four-sided minute pixel electrode is rectangular in its plane shape; and

an area in which each of first to fourth nonconductive portions with a rectangular shape, which include said opposite electrode, overlaps with said rectangular pixel electrode has a narrower width in a direction of a longer side of the pixel electrode than a width in a direction of a shorter side of the pixel electrode, in view of Z direction.

57. (Currently Amended) A liquid crystal element according to Claim 53, ~~any one of Claims 53 to 55~~, wherein said four-sided minute pixel electrode is square in its plane shape.

58. (Currently Amended) A liquid crystal element according to Claim 53, ~~any one of Claims 53 to 57~~, wherein said four-sided minute pixel electrode is a pixel electrode for a color display in which a pixel for three primary colors is arrayed in a mosaic.

59. (Currently Amended) A liquid crystal element according to Claim 56, ~~any one of Claims 56 to 57~~, wherein said four-sided minute pixel electrode is composed of three four-sided minor pixel electrodes for three primary colors, which are arrayed vertically to a direction of a longer side of said first to fourth nonconductive portions with a rectangular shape.

60. (Currently Amended) A liquid crystal element according to Claim 53, ~~any one of Claims 53 to 59~~, wherein said nonconductive portion with a rectangular shape is a nonconductive portion with a lap of 2μ in which a width of its shorter side is larger by 4μ or more than a gap between two opposite pixels through its longer side.

61. (Currently Amended) A liquid crystal element according to Claim 53, ~~any one of Claims 53 to 60~~, comprising a group of minor nonconductive portions which include an opposite electrode corresponding to at least a part of a gap between two opposite pixel electrodes or minor pixel electrodes through two longer sides of the nonconductive portion, instead of at least one of said first to fourth nonconductive portions.

62. (Original) A liquid crystal element, wherein a four-sided minute pixel electrode is arrayed in a delta system for a color display on a display plane, comprising:

when a pixel row of i -th position from a bottom side upward is defined as $q(i)$ and

a group of three adjacent pixels of red, green and blue, which is composed of one of red, green and blue pixels in an odd pixel row $q(2m+1)$ [m : an integer] and one of red, green and blue pixels in an even pixel row $q(2m+2)$, is defined as a group of pixels for a color display and

a group of pixels for a color display of j -th position from a left side on $q(2m+1)$ and $q(2m+2)$ is defined as $Gq(j)$,

a first T-shaped nonconductive portion which includes an opposite electrode corresponding to each of at least a part of a gap between two adjacent pixels on $q(2m+1)$ in a group of pixels for a color display composed of two pixels on $q(2m+1)$ and a pixel on $q(2m+2)$ as well as at least a part of a pixel on $q(2m+2)$ facing said two pixels on $q(2m+1)$;

a first reverse T-shaped nonconductive portion adjacent to said first T-shaped nonconductive portion, which includes an opposite electrode corresponding to each of at least a part of a gap between two adjacent pixels on $q(2m+2)$ in a group of pixels

for a color display composed of a pixel on $q(2m+1)$ and two pixels on $q(2m+2)$ as well as at least a part of a pixel on $q(2m+1)$ facing said two pixels on $q(2m+2)$;

a second T-shaped nonconductive portion shifted leftward by a pixel from said first T-shaped nonconductive portion, which includes an opposite electrode corresponding to each of at least a part of a gap between two adjacent pixels on $q(2m+3)$ in a group of pixels for a color display composed of two pixels on $q(2m+3)$ and a pixel on $q(2m+4)$ as well as at least a part of a pixel on $q(2m+4)$ facing said two pixels on $q(2m+3)$;

a second reverse T-shaped nonconductive portion adjacent to said second T-shaped nonconductive portion, which includes an opposite electrode corresponding to each of at least a part of a gap between two adjacent pixels on $q(2m+4)$ in a group of pixels for a color display composed of a pixel on $q(2m+3)$ and two pixels on $q(2m+4)$ as well as at least a part of a pixel on $q(2m+3)$ facing said two pixels on $q(2m+4)$;

a third T-shaped nonconductive portion shifted leftward by a pixel from said second T-shaped nonconductive portion, which includes an opposite electrode corresponding to each of at least a part of a gap between two adjacent pixels on $q(2m+5)$ in a group of pixels for a color display composed of two pixels on $q(2m+5)$

and a pixel on $q(2m+6)$ as well as at least a part of a pixel on $q(2m+6)$ facing said two pixels on $q(2m+5)$; and

a third reverse T-shaped nonconductive portion adjacent to said third T-shaped nonconductive portion, which includes an opposite electrode corresponding to each of at least a part of a gap between two adjacent pixels on $q(2m+6)$ in a group of pixels for a color display composed of a pixel on $q(2m+5)$ and two pixels on $q(2m+6)$ as well as at least a part of a pixel on $q(2m+5)$ facing said two pixels on $q(2m+6)$.

63. (Original) A liquid crystal element according to Claim 62, comprising:

a longitudinal minor nonconductive portion forming a longitudinal area of the nonconductive portion between adjacent pixels in the same pixel row;

a lateral minor nonconductive portion forming a lateral area between said adjacent pixels and a pixel in the same group of pixels for a color display as said adjacent pixels, which is opposite to both of these pixels; and

a cutting portion of the nonconductive portion dividing said longitudinal minor nonconductive portion and said lateral minor

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nonconductive portion, instead of at least one of said first to third T-shaped and reverse T-shaped nonconductive portions.

64. (Currently Amended) A liquid crystal element according to Claim 62 ~~or 63~~, wherein said longitudinal minor nonconductive portion and lateral minor nonconductive portion instead of at least one of said first to third T-shaped and reverse T-shaped nonconductive portions is a nonconductive portion with a lap of 2μ having a common area with a width of at least 2μ , in view of Z direction at a right angle with a display plane on which a pixel is arrayed.